Jack Girard
ECE 637
Final Exam

$\boxed{4}$

4.1) $\boxed{\dfrac{d\lambda_x}{dx} = -u(x)\lambda_x}$

4.2) separate variables: $\dfrac{1}{\lambda_x}d\lambda_x = -u(x)dx$

$$\int \frac{1}{\lambda_x} d\lambda_x = \int_0^x -u(t)dt$$ variable of integration "t"

$$\ln(\lambda_x) = \int_0^x -u(t)dt$$

$$\lambda_x = e^{-\int_0^x u(t)dt} = e^{[-\int_0^x u(t)dt]+C} = e^C e^{-\int_0^x u(t)dt} = \boxed{\lambda_0 e^{-\int_0^x u(t)dt}}$$

4.3 $\dfrac{\lambda_x}{\lambda_0} = e^{-\int_0^x u(t)dt} \rightarrow \log\left(\dfrac{\lambda_x}{\lambda_0}\right) = -\int_0^x u(t)dx \rightarrow -\log\left(\dfrac{\lambda_x}{\lambda_0}\right) = \int_0^x u(t)dt$

random variable

assume $E[Y_x] = \lambda_x \approx Y_x$; $-\log\left(\dfrac{Y_x}{\lambda_0}\right) \approx \int_0^x u(t)dt$

at depth $x = T$: $\int_0^T u(t)dt = -\log\left(\dfrac{Y_T}{\lambda_0}\right)$

let variable of substitution be x instead: $\boxed{\int_0^T u(x)dx \approx -\log\left(\dfrac{Y_T}{\lambda_0}\right)}$

4.4) The result of $\int_0^T u(x)dx$ is the projection of density along a path at a certain angle through the object being scanned. If enough unique projections are calculated, the object can be reconstructed using established mathematical methods.